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ALLOCATIVE EFFICIENCY OF PART-TIME AND FULL-TIME FARMS: THE CASE OF THAILAND

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ABSTRACT

The allocative efficiency of farm resource use on part-time and full-time farms is examined in Northern and Northeastern Thailand. Few differences were found between the two types of farms. Both types overutilize land and labor, while the use of capital and other expenses is closer to optimum levels.

BIOGRAPHICAL SKETCHES

Yongyuth Chalamwong is an Assistant Professor of Agricultural Economics at Kasetsart University, Bangkok, and is currently a Visiting Assistant Professor of Agricultural Economics at The Ohio State University. He has a Ph.D. from Pennsylvania State University and has conducted several research projects in Thailand related to agricultural demography, rural off-farm employment and rural development.

Richard L. Meyer is Director of International Programs and Professor of Agricultural Economics at The Ohio State University. He has a Ph.D. from Cornell University and has conducted research in several developing countries. He worked with researchers from Michigan State University and Kasetsart University on the field research that collected the data used in this study.

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INTRODUCTION

The discovery that rural people earn substantial amounts of income from a wide variety of non-farm sources has stimulated interest in policies to encourage rural non-farm enterprises (Onchan and Chalamwong, World Bank). Studies have emphasized the careful measurement of the total income earned by farm households in order to more clearly evaluate the incidence of rural poverty (Chalamwong and Meyer). Since reducing poverty has been an important objective of policy analysis during the past decade, it is not surprising that less attention has been paid to the efficiency implications of encouraging farm households to earn more income off the farm. But with many countries in a precarious food situation, efficiency of farm resource use cannot be ignored.

A recent large-scale survey of farm households in Thailand showed that many households spent 50 percent or more of total household work time on non-farm enterprises in the household or in off-farm work. Many households earned 30 to 50 percent of total income from these sources. Thai policymakers have contemplated policies to stimulate this type of rural employment because of the assumption that rural labor was underemployed, particularly during the dry season. Little attention was given, however, to the possible impact on farm efficiency and food production if more household labor is channeled into these activities.

This paper reports on a study of the efficiency of part and full-time Thai farms. The central question is whether or not a significant difference exists in efficiency in farm resource use.

PART-TIME FARMING ISSUES

Allocative efficiency in resource use is achieved by equating the marginal value product of each input with its price. There is little consensus in the literature about the expected relationship between efficiency and part-time farming. Kada expected lower efficiency of machinery and capital equipment use on part-time farms due to smaller farm size and time constraints. However, Singh and Williamson concluded that part-time farms were not inefficient in food production and O'Grady found no difference in land use between full-time and part-time farmers. A problem is that researchers mix the concepts of allocative efficiency, which may be most important for private returns, with intensity of factor use, which may be most important from the social point of view.

An important issue in developing countries is how farm households respond to different opportunity sets of off-farm work. Because of differences in education, skills, age, health, location of farm and other factors, farm household members are not likely to respond the same to off-farm work opportunities. However, the nature and extent of their response may influence the efficiency of resource use.

Definitions of part-time and full-time farms vary among researchers. All researchers must select an appropriate unit of analysis and type of activity to be evaluated. Some studies consider only the activities of farm operators (Hall), while others include the activities of all family members (Hanson and

Spitze). Selecting the family as the analytical unit seems most appropriate because it is the basic decision-making unit for consumption and expenditure (Kada). Choosing the family unit is even more appropriate in traditional agriculture because one type of unspecialized labor should easily substitute for another, in both entrepreneurial and labor inputs.

A second definitional problem concerns selection of income versus time as the measure of involvement in off-farm work. The income variable reflects commitment to and dependency on an activity. The household may manage an activity with greater care if it generates a larger share of household income. But income reflects both quantity and marginal value of time, so time allocation rather than income should provide a better measure.

Another definitional issue concerns the type of activities counted as off-farm. Seasonal labor on another person's farm, off-farm custom work, self-employment in non-farm businesses, and many other activities might be included in a definition of off-farm work. Work away from one's own farm may affect farm efficiency differently than household activities such as silk weaving, basket making and blacksmithing. The experience of off-farm work may have an effect similar to extension and education in encouraging the transfer of new ideas and adoption of new technology. We include only off-farm activities as off-farm work.

The final definitional problem concerns the amount of off-farm work necessary to classify a farm as part-time. Part-time

farms have been defined as those reporting at least one day of off-farm work in a year (Hall), 30 days of work by all family members during the year (Kada), or more than 50 percent of the working time spent off-farm (Singh and Williamson). The median percent of hours worked off-farm to total hours spent on farm and off-farm activities by all family members in the household - 20 - was used as the dividing point between part and full-time in this study.

METHODOLOGY AND DATA

Following Hall, a simple model of time allocation was used in this study. Maximization of a utility function consisting of leisure and a composite comsumption good is assumed. A farm production function with decreasing returns to labor, and off-farm work opportunities is specified. Total time is constrained so the individual can sell leisure for the market wage. Utility is maximized when time is allocated so the marginal return to labor in each use and the marginal return to leisure are all equal. The opportunity set for off-farm work for two groups of farms may differ and influence the demand for farm labor and, therefore, the amount of time spent in off-farm work. Off-farm work may increase or decrease the efficiency of labor use on the farm. Inefficiency in the use of one factor of production, such as labor, can also influence the demand for other factors.

To test allocative efficiency of part and full-time farms, survey data were fitted to a modified Cobb-Douglas production function of the form (in logarithms):

$$(1) \quad \ln V = \ln A + \sum_{j=1}^{4} b_j \ln x_j + \varepsilon$$

V_i, gross value of agricultural production (baht),[1] included the total value of crops, livestock, and livestock products produced during the year. x_1 measured the total number of rai cropped during the year.[2] x_2 represented the hours of labor units used. Weights for conversion were 1 for adult males aged 15-65, 0.75 for adult females, and 0.5 for children under 15 and adults over 65 years.[3] x_3 was estimated as the value of capital services (baht) from farm machinery, tools, and animal power. Machinery services included depreciation charges, repairs and operating expenses plus the costs of hired-in machine power. Draft animal services included the imputed value of owned animal power plus the costs of rented-in animal power. x_4, other expenses (baht), included all other expenses such as chemical inputs, fertilizer, and livestock feed. ε_i is the random disturbance term.

To analyze allocative efficiency of full and part-time farms, the first order conditions of equation (1) were used to derive the marginal conditions of the two groups. Under the assumption of allocative efficiency with perfect competition in both product and input markets, the following equilibrium condition is derived:

1/ Approximately 20 Baht = $1.00.

2/ One rai = 0.4 acres.

3/ An examination of farm wage rates showed a pattern roughly comparable to these weights. These weights have also been used in other research in Thailand (Banno).

$$(2) \quad MVP_{x_j} = \frac{\partial V_i}{\partial x_j} = \frac{b_j \cdot \bar{V}_i}{\bar{x}_j} = Px_j$$

The bar indicates geometric mean, b_j is the output elasticity of the jth input and Px_j is the price of the jth input. The measure of allocative efficiency is:

$$(3) \quad C_j = \frac{MVP_{x_j}}{Px_j}$$

C_j equals one at optimum resource use. When C_j is greater (lesser) than one, too little (much) of an input is being utilized, given the input price and the level of usage of other resources. It is important to determine if farms allocate resources efficiently and if there are differences in allocative efficiency between the two groups.

The data used in this research were collected during the 1980/81 crop year. The overall sample consisted of 424 farm households selected from 25 Thai villages in the provinces of Chiang Mai, Khon Kaen, Roi Et, and Suphan Buri.[4/] A total of 274 households with usable data were located in the North (Chiang Mai) and Northeast (Khon Kaen and Roi Et).

The descriptive results are reported in Table 1. These two regions were selected for comparative analysis because of their sharp differences. The North has smaller farms located closer to off-farm work opportunities in the second largest city in the country. Some of the households in the Northeast are quite distant from urban areas. The farms tend to be larger, have poorer soil, and are more subject to periodic drought.

4/ See Mead and Meyer for sampling and data collection procedures.

Seventy-three percent of the northern farms were classified as part-time compared to 37 percent in the Northeast. Part-time farms cultivated only 60 to 70 percent as much land as full-time farms. Average farm size for both groups was substantially less in the North. The average amount of labor and capital services used per rai of land was approximately the same in both regions for both farm types. Other expenses were also similar, except for full-time farms in the North which used relatively more fertilizer inputs. The value of output per rai was also highest for this group of farms.

REGRESSION RESULTS

The analysis followed a two-step procedure. First, regression models were run separately for the two regions. The Chow test of equality between sets of coefficients in the two regional models compared to the pooled regression showed the results for the two regions were significantly different. Second, the process was repeated in each region for full-time and part-time models. These results were also significantly different.

The results for the four regressions are reported in Table 2. The results seem reasonable with most coefficients of the expected sign and the explanatory power of the models typical for cross-section data. Generally the model seemed to fit full-time farms somewhat better than part-time. The land and labor variables explained most of the value of production as was expected in areas such as these in Thailand with fairly traditional agricultural production techniques. The coefficients for these two

Table 1. The Geometric Mean of Output and the Input Variables by Farm Type and Region

Items	Northeast				North			
	Full-Time		Part-Time		Full-Time		Part-Time	
	Per Farm	Per rai	Per Farm	Per rai	Per Farm	Per rai	Per Farm	Per rai
Value of Output (B)	13,959.35	674.69	9,333.34	701.75	15,952.75	1,328.29	9,184.29	1,092.07
Land (rai)	20.69	--	13.30	--	12.01	--	8.41	--
Labor (hrs.)	3,626.69	175.29	2,531.01	190.30	2,174.53	181.06	1,550.49	184.36
Capital (B)	2,292.43	110.80	1,424.96	107.14	1,315.39	109.52	961.74	114.36
Other Expenses (B)	751.81	36.34	446.35	33.56	1,167.90	97.24	418.01	49.70
Number of Farms	111	--	67	--	26	--	70	--

variables were somewhat unstable due to colinearity for the full-time model in the North and the land variable picked up much of the effect of labor.

The estimates for the marginal value products of inputs and allocative efficiency are shown in Table 3. The labor variable is most interesting as it was expected that off-farm work would influence the efficiency of labor use. Both regions and both types of farms, however, show overutilization of labor. Even in the North where off-farm work is more prevalent, there still is significant overutilization of labor on the survey farms. Land also tends to be overutilized. The exception appears to be the full-time farms in the North but, as noted above, the productivity of land is overestimated because it picked up the effect of labor. We have little reason to expect that the productivity of land and labor on these farms would be much different than for the other three groups.

The variables for capital and other expenses showed mixed results. With the exception of the part-time farms in the Northeast, capital was overutilized. Other expenses were either underutilized or close to optimum use with the exception of the full-time farms in the North which reported two to three times the amount of expenses per rai compared to the other groups.

There is no generally accepted understanding of why capital and operating expenses might be underutilized in Thailand. One study in the Northeast speculated that risk aversion and capital rationing might constrain resource use (Bobst, et al.), while

Table 2. Ordinary Least Squares Estimates of the Cobb-Douglas Production Function for Full-Time and Part-Time Farms by Region

Items		Region			
		Northeast		North	
		Full-Time	Part-Time	Full-Time	Part-Time
Intercept		4.1760 (4.60)[a/]	3.5181 (3.20)	7.5548 (4.82)	4.6678 (7.23)
Land	(x1)	0.2032 (2.80)	0.0790 (0.67)	0.7619 (3.45)	0.2731 (2.59)
Labor	(x2)	0.4797 (3.92)	0.3653 (2.07)	-0.0382 (-0.15)	0.4386 (4.41)
Capital	(x3)	-0.0481 (-0.66)	0.3136 (3.19)	0.0467 (0.38)	0.0390 (0.71)
Other Expenses	(x4)	0.1800 (5.59)	0.0457 (0.87)	0.0264 (0.47)	0.0638 (2.34)
R^2		0.4728	0.3847	0.5624	0.5238
F-Value		23.76	9.69	6.75	17.87
E.S.S.		29.34	28.99	8.42	21.38
N		111	67	26	70

a/ t-ratio in parentheses

Table 3. Estimates of Marginal Value Products of Inputs and Allocative Efficiency for Full-Time and Part-Time Farms by Region

Variable		Northeast				North			
		Full-Time		Part-Time		Full-Time		Part-Time	
		Marginal Product	Efficiency	Marginal Product	Efficiency	Marginal Product	Efficiency	Marginal Product	Efficiency
Land	(rai)[a/]	137.10	0.27	55.44	0.11	1,012.02	1.12	298.24	0.33
Labor	(hr.)[b/]	1.85	0.40	1.35	0.29	0.28	0.06	2.60	0.56
Capital	(B)	-0.29	-0.29	2.05	2.05	0.57	0.57	0.37	0.37
Other Expenses	(B)	3.34	3.34	0.96	0.96	0.36	0.36	1.40	1.40

a/ The rental rate estimated from sample data was B 500 per rai in the Northeast and B 900 per rai in the North.

b/ The estimated weighted average farm wage rates were B 4.65 per hour in both regions.

another emphasized risk aversion as a factor explaining crop production in the dry season (Brannon, et al.). A major effort has been made to expand formal agricultural credit supplies but only 42 percent of the farms in the entire sample reported outstanding loans from any source at the beginning of the survey. Thus risk aversion rather than external credit rationing is a more plausible explanation for those cases where capital and other expenses are underutilized.

IMPLICATIONS

Although somewhat preliminary, the implications of this research are encouraging for Thai policymakers. A dual rural development strategy is suggested. On the one hand, substantial progress can be made in increasing rural employment and reducing poverty by increasing agricultural productivity through improved seed, increased fertilizer use and multiple cropping. Thailand's cropping intensity and rice yields, for example, are relatively low compared to some other Asian countries. Major efforts are being made to increase both. On the other hand, off-farm work and part-time farming may be encouraged without reducing farm efficiency. In fact, there may be gains in efficiency, especially in land and labor use, as proportionately more family labor is allocated to off-farm work. In other research, we have shown that adult males and females respond positively to off-farm wage rates (Chalamwong and Meyer). Thus, increased off-farm employment and wage rates may be an important and efficient second means to increase farm household income in Thailand.

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